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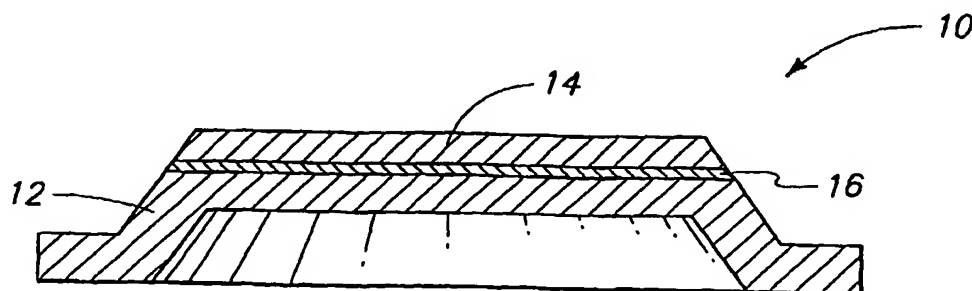
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- (74) Agent: Wells St. John P.S.; 601 West First Avenue, Suite 1300, Spokane, Washington 99201-3828 (US).
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(54) Title: COPPER-CONTAINING PVD TARGETS AND METHODS FOR THEIR MANUFACTURE



(57) Abstract: The invention includes a physical vapor deposition target containing copper and at least two additional elements selected from Ag, Al, As, Au, B, Be, Ca, Cd, Co, Cr, Fe, Ga, Ge, Hf, Hg, In, Ir, Li, Mg, Mn, Nb, Ni, Pb, Pd, Pt, Sb, Sc, Si, Sn, Ta, Te, Ti, V, W, Zn and Zr, a total amount of the at least two additional elements being from 100 ppm to 10 atomic %. The invention additionally includes thin films and interconnects which contain the mixture of copper and at least two added elements. The invention also includes forming a copper-containing target. A mixture of copper and two or more elements is formed. The mixture is cast by melting and is subsequently cooled to form a billet which is worked utilizing one or both of equal channel angular extrusion and thermomechanical processing to form a target.

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US2004/027090

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C23C14/14 C23C14/32 C23C14/34

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C23C H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 882 813 A (JAPAN ENERGY CORPORATION) 9 December 1998 (1998-12-09) claims 1,5	1,11,17, 21,25
A	US 2001/035237 A1 (NAGANO SHOZO ET AL) 1 November 2001 (2001-11-01) paragraphs '0022!', '0023!', '0027!; claims 1,31,42 & US 2001/035238 A1 (NAGANO SHOZO ET AL) 1 November 2001 (2001-11-01) & WO 01/39250 A (HONEYWELL INTERNATIONAL INC) 31 May 2001 (2001-05-31) & US 2002/014289 A1 (NAGANO SHOZO ET AL) 7 February 2002 (2002-02-07)	1,11,17, 21,25
A	US 2003/052000 A1 (SEGAL VLADIMIR ET AL) 20 March 2003 (2003-03-20) claims 26-32,36	1,11,17, 21,25

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the International filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the International filing date but later than the priority date claimed

\*T\* later document published after the International filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*G\* document member of the same patent family

Date of the actual completion of the International search

29 April 2005

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12/05/2005

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2004/027090

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

Continuation of Box II.2

Present claims 1, 11, 17, 21 and 25, relate to an extremely large number of possible products. Support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT is to be found, however, for only a very small proportion of the products claimed. In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Consequently, the search has been carried out for those parts of the claims which appear to be supported and disclosed, namely claims 1, 11, 17, 21 and 25 have been restricted to the following characteristics:

- the first added element being Sn or Ag
- the second added element being Al, Zn, In or Ti

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/027090

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